1   **WHAT IS CLAIMED IS:**

2   (Currently Amended) 1.   A method of simulating physical dynamics of a

3   predetermined set of objects that are part of a computer/video game, the objects

4   connected to each other at one or more respective links, with at least one link representing

5   a hard contact between separate objects, <u>wherein</u> the method <u>utilizes a game system</u>

6   comprising <u>a collision subsystem, a dynamics subsystem, a game logic subsystem, a</u>

7   <u>graphics subsystem and one or more central processing units supporting the game system;</u>

8   <u>the method further comprising</u>:

9   a.   grouping a first and a second object in the predetermined set of

10   objects to define a first binary object;

11   b.   ~~solving a solution for the physical dynamics~~ <u>solving for the</u>

12   <u>physical dynamics</u> of the objects in the first binary object at a first set of links;

13   c.   grouping a third object to the first binary object to define a second

14   binary object, the third object having at least one link to the first binary object, thereby

15   defining a second set of links;

16   d.   solving a solution for the physical dynamics of the objects in the

17   second binary object at the second set of links; and

18   e.   recursively grouping additional objects to create additional binary

19   objects and solving for the physical dynamics of the additional binary objects.

20   (Original)   2.   The method of claim 1 including the step of

21   providing, for each link, one or more link weight values operable to constrain the

22   solution.

23   (Currently Amended) 3.   The method of claim 2 further including the step of

24   ~~performing multiple iterative solutions~~ <u>performing an iterative solution method multiple</u>

times where at least one link weight value is adjusted at each iteration.

(Original)   4.   The method of claim 3 where the link weight values are adjusted to maintain a set of constraints on the links within a predetermined acceptable tolerance.

(Original)   5.   The method of claim 4 where the set of constraints includes the following constraints: the objects cannot interpenetrate each other and no adhesive normal forces are applied at the links.

(Original)   6.   The method of claim 5 where the predetermined acceptable tolerance includes a predetermined amount of interpenetration at a link.

(Original)   7.   The method of claim 6 where the predetermined acceptable tolerance includes a predetermined amount of adhesive normal force at a link.

(Currently Amended) 8.   The method of claim 7 where the set of constraints further includes the constraint that, at a respective link, either the relative lateral motion is zero or the friction force at the link is equal to the normal force times ~~the coefficient of friction~~ a coefficient of friction.

(Original)   9.   The method of claim 8 where the predetermined acceptable tolerance includes a predetermined difference between the friction force at a link and the normal force times the coefficient of friction.

(Currently Amended) 10.   A method of simulating physical dynamics of a predetermined set of objects that are part of a computer video game, the objects connected to each other by at least one respective link, and where at least one object is not a rigid body, wherein the method utilizes a game system comprising a collision subsystem, a dynamics subsystem, a game logic subsystem, a graphics subsystem and one

1   or more central processing units supporting the game system; the method further

2   comprising:

3   a.   providing, for at least one object, a set of reaction values

4   describing the motion of the object in response to applied forces;

5   b.   ~~solving a solution to the physical dynamics~~ solving for the physical

6   dynamics of the set of objects using the reaction values;

7   c.   changing the reaction values in response to force for at least one

8   object to provide a set of adjusted reaction values;

9   e d.   ~~solving a solution to the physical dynamics~~ solving for the physical

10   dynamics of the objects using the set of adjusted reaction values; and

11   f e.   repeating steps c and e until the solution of step d is within a

12   predetermined acceptable tolerance.

13   (Original)   11.   The method of claim 10 further including the step of

14   creating a nested grouping of a plurality of binary objects from the objects in the set.

15   (Currently Amended) 12.   The method of claim 11 where the step of solving a

16   solution for the physical dynamics of the objects includes the step of starting with the

17   most deeply nested binary object and proceeding outward, ~~solving a solution for the~~

18   ~~physical dynamics~~ solving for the physical dynamics of the objects in the binary objects at

19   the respective links.

20   (Original)   13.   The method of claim 12 further including the step of

21   providing, for each link, one or more link weight values operable to constrain the

22   solution.

23   (Original)   14.   The method of claim 13 where the step of changing

24   the reaction values for at least one object further includes the step of adjusting at least one

1   link weight value.

2   (Original)   15.   The method of claim 14 where the link weight

3   values are adjusted to maintain a set of constraints on the links within a predetermined

4   acceptable tolerance.

5   (Currently Amended) 16.   A method of simulating physical dynamics of a

6   predetermined set of objects that are part of a computer/video game, the objects

7   connected to each other at one or more respective links, with at least one link representing

8   a hard contact between separate objects, wherein the method utilizes a game system

9   comprising a collision subsystem, a dynamics subsystem, a game logic subsystem, a

10   graphics subsystem and one or more central processing units supporting the game system;

11   the method further comprising:

12   a.   grouping the objects in the predetermined set of objects into two

13   binary objects to define a first binary object and a second binary object;

14   b.   grouping the objects in the first binary object into a subgroup of

15   binary objects to define a nested group of binary objects in the first binary object;

16   c.   grouping the objects in the second binary object into a subgroup of

17   binary objects to define a nested group of binary objects in the second-binary object; and

18   d.   starting with the most deeply nested binary object and proceeding

19   outward, solving a solution for the physical dynamics of the objects in the binary objects

20   at the respective links.

21   (Original)   17.   The method of claim 16 including the step of

22   providing, for each link, one or more link weight values operable to constrain the

23   solution.

24   (Currently Amended) 18.   The method of claim 17 further including the step of

1   ~~performing multiple iterative solutions~~ performing an iterative solution method multiple

2   times where at least one link weight value is adjusted at each iteration.

3   (Original)   19.   The method of claim 18 where the link weight

4   values are adjusted to maintain a set of constraints on the links within a predetermined

5   acceptable tolerance.

6   (Original)   20.   The method of claim 19 where the set of constraints

7   includes the following constraints: the objects cannot interpenetrate each other and no

8   adhesive normal forces are applied at the links.

9   (Original)   21.   The method of claim 20 where the predetermined

10   acceptable tolerance includes a predetermined amount of interpenetration at a link.

11   (Original)   22.   The method of claim 21 where the predetermined

12   acceptable tolerance includes a predetermined amount of adhesive normal force at a link.

13   (Currently Amended) 23.   The method of claim 22 where the set of constraints

14   further includes the constraint that, at a respective link, either the relative lateral motion is

15   zero or the friction force at the link is equal to the normal force times ~~the coefficient of~~

16   ~~friction~~ a coefficient of friction.

17   (Original)   24.   The method of claim 23 where the predetermined

18   acceptable tolerance includes a predetermined difference between the friction force at a

19   link and the normal force times the coefficient of friction.

20   (Currently Amended) 25.   A method of simulating the physical dynamics of a

21   predetermined set of objects that are part of a computer/video game, the objects

22   connected to each other at one or more links, at least one object represented by a plurality

23   of polygons, wherein the method utilizes a game system comprising a collision

24   subsystem, a dynamics subsystem, a game logic subsystem, a graphics subsystem and one

or more central processing units supporting the game system; the method further comprising:

a. creating a nested grouping of a plurality of binary objects from the objects in the set, at least one binary object containing two or more links; and

b. starting with the most deeply nested binary object and proceeding outward, ~~solving a solution for the physical dynamics~~ solving for the physical dynamics of the objects in the binary objects at ~~the respective links~~ said one or more links.

(Original)   26.   The method of claim 25 where the solution maintains a set of constraints on the links within a predetermined acceptable tolerance.

(Original)   27.   The method of claim 26 where the set of constraints includes the following constraints: the objects cannot interpenetrate each other and no adhesive normal forces are applied at the links.

(Original)   28.   The method of claim 27 where the predetermined acceptable tolerance includes a predetermined amount of interpenetration at a link.

(Original)   29.   The method of claim 28 where the predetermined acceptable tolerance includes a predetermined amount of adhesive normal force at a link.

(Currently Amended) 30.   The method of claim 29 where the set of constraints further includes the constraint that, at a respective link, either the relative lateral motion is zero or the friction force at the link is equal to the normal force times ~~the coefficient of friction~~ a coefficient of friction.

(Original)   31.   The method of claim 30 where the predetermined acceptable tolerance includes a predetermined difference between the friction force at a link and the normal force times the coefficient of friction.

(Original)   32.   The method of claim 31 including the step of

1   providing, for each link, one or more link weight values operable to constrain the

2   solution.

3   (Currently Amended) 33.   The method of claim 32 further including the step of

4   ~~performing multiple iterative solutions~~ performing an iterative solution method multiple

5   times where at least one link weight value is adjusted at each iteration.

6   (Currently Amended) 34.   A method of simulating the physical dynamics of a

7   predetermined set of objects that are part of a video game, the objects connected to each

8   other at at least one respective link, wherein the method utilizes a game system

9   comprising a collision subsystem, a dynamics subsystem, a game logic subsystem, a

10   graphics subsystem and one or more central processing units supporting the game system;

11   the method further comprising:

12   a.   providing a set of equations that when solved define a solution to

13   the physical dynamics of ~~the set of the predetermined set of objects~~ the predetermined set

14   of objects, the solution having the following constraints: the objects cannot interpenetrate

15   each other and no adhesive normal forces can be applied at the links;

16   b.   assigning at least one link weight to each of the links in the

17   predetermined set of objects;

18   c.   ~~solving an iterative solution for the physical dynamics of the~~

19   ~~objects using the assigned weights~~ solving for the physical dynamics of the objects using

20   the assigned weights using an iterative solution method;

21   d.   adjusting the assigned link weights if the constraints are violated at

22   a link;

23   e.   solving an iterative solution for the physical dynamics of the

24   objects using the adjusted weights; and

1   f. repeating steps d. and e. until a solution is within a predetermined

2   acceptable tolerance.

3   (Currently Amended)   35.   The method of claim 34 wherein ~~the~~ a

4   predetermined acceptable tolerance includes a predetermined amount of adhesive normal

5   force at a link.

6   (Original)   36.   The method of claim 35 wherein the predetermined

7   acceptable tolerance includes a predetermined amount of interpenetration between two

8   objects at a link.

9   (Original)   37.   The method of claim 36 wherein the weights are

10   decreased for links where adhesive normal force is applied.

11   (Original)   38.   The method of claim 37 wherein the weights are

12   increased for links where interpenetration occurs.

13   (Currently Amended) 39.   A method of simulating the physical dynamics of a

14   predetermined set of objects that are part of a video game, the objects connected to each

15   other at one or more respective links, wherein the method utilizes a game system

16   comprising a collision subsystem, a dynamic subsystem, a game logic subsystem, a

17   graphics subsystem and one or more central processing units supporting the game system;

18   the method further comprising:

19   a.   providing a set of equations that when solved define a solution to

20   the physical dynamics of ~~the set of the predetermined set of objects~~ the predetermined set

21   of objects, the solution having the following constraints: the objects cannot interpenetrate

22   each other and no adhesive normal forces can be applied at the links, and that, at a

23   respective link, either the relative lateral velocity is zero, or the friction force is equal to

24   the normal force at the link times ~~the~~ a coefficient of friction;

1   b.   assigning at least one link weight to each of the links in the

2   predetermined set of objects;

3   c.   ~~solving an iterative solution for the physical dynamics of the~~

4   ~~objects using the assigned weights~~ <u>solving for the physical dynamics of the objects using</u>

5   <u>the assigned weights using an iterative solution method</u>;

6   d.   adjusting the link weights assigned to the links if the constraints

7   are violated at a link;

8   e.   solving an iterative solution for the physical dynamics of the

9   objects using the adjusted weights; and

10   f.   repeating steps d. and e. until a solution is within a predetermined

11   acceptable tolerance.

12   (Original)   40.   The method of claim 39 wherein ~~the~~ <u>a</u>

13   predetermined acceptable tolerance includes a predetermined amount of adhesive normal

14   force at a link.

15   (Original)   41.   The method of claim 40 wherein the predetermined

16   acceptable tolerance includes a predetermined amount of interpenetration between two

17   objects at a link.

18   (Currently Amended) 42.   The method of claim 41 where the predetermined

19   acceptable tolerance includes a predetermined difference between the friction force at a

20   link and the normal force times ~~the~~ <u>a</u> coefficient of friction.

21   (Original)   43.   The method of claim 42 wherein the weights are

22   decreased for links where adhesive normal force is applied.

23   (Original)   44.   The method of claim 43 wherein the weights are

24   increased for links where interpenetration occurs.

1   (Currently Amended) 45.   A system for simulating the physical dynamics of a

2   set of objects within a video game, the objects connected to each other at one or more

3   respective links, the system comprising:

4   a.   a binary division unit having logic operable to create~~ing~~ a nested

5   grouping of a plurality of binary objects from the objects in the set; ~~and~~

6   b.   a dynamics unit having logic operable to solve a set of physical

7   dynamics equations; and

8   c.   one or more central processing units supporting the system.

9   (Original)   46.   The system of claim 45 where the dynamics unit

10   comprises a set of multiple processors, each processor operable to solve a set of physical

11   dynamics equations.

12   (Original)   47.   The system of claim 46 where said multiple

13   processors are used to solve the dynamics equations of multiple binary objects in parallel.

14   (Currently Amended) 48.   The system of claim 47 where each link includes

15   one or more link weight values operable to constrain ~~the~~ a solution.

16   (Currently Amended) 49.   The system of claim 48 where the dynamics unit

17   further comprises logic operable to ~~perform multiple iterative solutions~~ perform an

18   iterative solution method multiple times wherein one or more link weight values are

19   adjusted at each iteration.

20   (Original)   50.   The system of claim 49 where the link weight

21   values are adjusted to maintain a set of constraints for each link within a predetermined

22   tolerance.

23   (Original)   51.   The system of claim 50 where said set of constraints

24   includes the following constraints: the objects cannot interpenetrate each other and no

1 adhesive normal force is applied.

2 (Original)   52. The system of claim 51 where the set of constraints

3 further includes the constraint that, at a respective link, either the relative lateral motion

4 between the objects is zero or the friction force at the link is equal to the normal force

5 multiplied by ~~the~~ a coefficient of friction.